ARJUNA

JEE

LECTURE - 02

Mole Concept

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STATES OF MATTER

Matter

Gaseous state

liquid solid

solid state

NO force act between molecules

force act blw molecules

high force of Attraction blw molecules

EFFECT OF PHYSICAL STATE ***

State → define → Variable

1. Mass
2. Number of atom
3. Pressure
4. Volume
5. temperature
6. density

MASS OF SUBSTANCE

Mass of substance does not depend upon physical state of matter

1 gram H_2O Vapour

↓

1g H_2O (liquid)

↓

1 gram ice (H_2O solid)

Unit of Mass.

$\Rightarrow$ 1 Kg = 1000 gram

Q. 12 gram sodium solid convert into vapour (gas) of sodium atom. How many gram of sodium (Na) vapour (gas)?

A 11 gram

B 12 gram

C 13 gram

D 14 gram

20 Sec

Soln → 12 gram Na(s) ⟶ 12 gram Na (vapour or gas)

VOLUME OF SUBSTANCE

Volume of substance depend upon physical state of matter

Ex→ $V_{gas} \neq V_{liq.} \neq V_{solid}$

order → $V_{gas} > V_{liq.} > V_{solid}$

V_{gas} → 1oml

Q x gram H_2 gas occupied 1oml volume in gaseous state. If complete H_2 gas convert into liquid state, than select correct option

(a) Mass of liquid H_2 = x gram

(b) Volume of liquid H_2 < 1oml

(c) 'a' and 'b' both correct

(d) None of these.

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Q. 9 gram water liquid occupied 500 mL volume. If whole water converted into gas phase. Select the correct statements.

20sec → Ans batao

A. Volume of H_2O in gas phase = 500 mL

B. Volume of H_2O in gas phase is greater than 500 mL

C. Volume of H_2O in gas phase is less than 500 mL

D. None of these

liquid → gas

$V_{liq.} < V_{gas}$

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DENSITY OF SUBSTANCE

$$\text{density of subs.} = \frac{\text{Mass of substance}}{\text{Volume of substance}}$$

Mass of substance ⟶ independent of physical state

Volume of substance ⟶ dependent on physical state

"Density of substance depend upon physical state of Matter"

$C_{SD} = 1$ → Concept by SARVesh Dixit

$\Rightarrow d \propto \frac{1}{V}$ → density → d_{gas} (1) < d_{liquid} (2) ≤ d_{solid} (3)

$d_{min.}$ V_{max}

→ density ⇒ Mass aur volume ka Relation batata hai

density of water = 1 g/ml at 4°C temp.

⇒ 1 gram water occupied 1ml water in liquid state

Ex ⇒ d = 2 gram/litre Alcohol

(a) 2 gram Alcohol occupied = 1 litre alcohol liquid

(b) 2 gram Alcohol occupied = 2 litre alcohol liquid

NUMBER OF MOLECULES

Number of molecules or atom does not depend upon physical state of matter

Ex → 1o molecule CO_2 gas
↓ cooling
1o molecule CO_2 liquid
↓ cooling
1o molecule CO_2 solid

Q. 100 molecules of CO_2 gas present in a container. If CO_2 gas converted in liquid CO_2. How many molecules of CO_2 present in liquid CO_2?

A 10 molecules

B 100 molecules

C 1 molecule

D 1000 molecules

20 Sec → Ans batao

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Q. Which of the following properties change (effected) when substance change in physical state? (more than one Ans correct)

A. Mass of substance

B. Number of molecules/ atoms of substance

C. ✓ Density of substance

D. ✓ Volume of substance

20 sec

Mass → ×

Number → ×

Volume → ✓

density → ✓

Q. Which of the following properties decreases when 4 gram CO_2 gas converted into CO_2 liquid?

10 Sec → Ans batao

gas ↓ liquid

A. Mass of CO_2 ✗

B. Volume of CO_2 ✓ ($V_g > V_{liq.}$) → decrease

C. Number of molecules of CO_2 → ✗

D. Density of CO_2 → (increase)

$C_{SD} = 2$

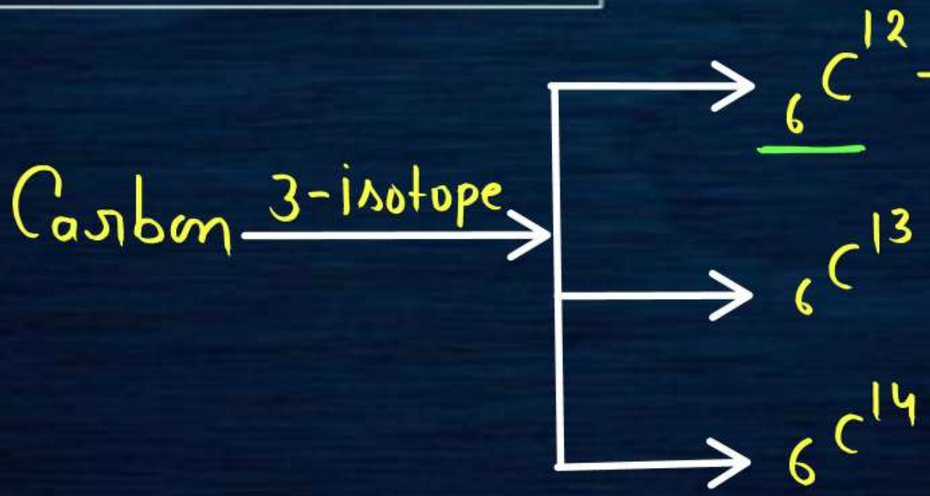
① Mass of molecules
Number of molecules
} → does not depend upon physical State of matter

② Volume of substance
density of substance
} → depend upon physical State of matter

MOLE

A mole is the amount of substance that contains as many species [Atoms, molecules, ions or other particles] as there are atoms in exactly 12 g of C-12

1 mole = 6.022×10^{23} species



⇒ 12 gram Carbon-12 isopers

↓

6.022×10^{23} Numbers

or

6.022×10^{23} particles

↓

Avogadro's Number (N_A)

12 gram C-12 isotope

↓

6.022×10^{23} Carbon atom = 1 mole

$C_{SD} = 3$

① 1 mole ____ = 6.022×10^{23} ____

② 1 mole oxygen → O_2
1 mole phosphurous → P_4
1 mole of sulphur → (S_8)
} → 6.022×10^{23} No. of natural form of molecule.

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Ex → 1 mole O-atom = 6.022×10^{23} No. of O-atom

Ex → 1 mole Oxygen molecules = 6.022×10^{23} No. of oxygen molecules (O_2)

Ex → 1 mole oxygen = 6.022×10^{23} No. of O_2 molecules

Ex → 1 mole Neon = 6.022×10^{23} No. of Ne-atom

Ex → 1 mole phosphorous = 6.022×10^{23} No. of P_4 molecules

Q 1 mole of Chlorine $= 6.022 \times 10^{23}$ No. of Chlorine molecule (Cl_2)

(a) atom

(b) molecules

(c) None of these

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Ex → 1 mole = 6.022×10^{23} Number = N_A number

$\frac{1}{2}$ mole = $\frac{N_A}{2}$ Number

2 mole = 2 N_A number

100 mole = 100 N_A number

$\frac{1}{100}$ mole = $\frac{N_A}{100}$ number

No. of mole in term of number of particles

$$\text{No. of mole of molecule} = \frac{\text{given number}}{6.022 \times 10^{23}} = \frac{N_g}{N_A}$$

$$\text{given number} = \text{mole} \times 6.022 \times 10^{23}$$

Q → 3.011×10^{23} molecules of CO_2 gas present in container.
How many mole of CO_2 gas in container.

Sol^n → $\text{No. of mole of } CO_2 = \frac{\text{given No.}}{6.022 \times 10^{23}} = \frac{3.011 \times 10^{23}}{6.022 \times 10^{23}} = \frac{1}{2}$

Q 12.044×10^{22} molecules of H_2O vapours Condense in liquid state. Calculate mole of H_2O liquid.

(a) $\frac{1}{2}$ mole

(b) 2 mole

✓ (c) 0.2 mole

(d) 0.02 mole

No. of mole of H_2O = $\frac{12.044 \times 10^{22}}{6.022 \times 10^{23}}$

$= \frac{2}{10} = \frac{1}{5} = 0.2$ mole

$C_{SD} = 4$

① Number → given ⇒ mole banana hai = $\frac{\text{Number}}{6.022 \times 10^{23}}$

② mole → given ⇒ Number banana hai ⇒ $\text{mole} \times 6.022 \times 10^{23}$

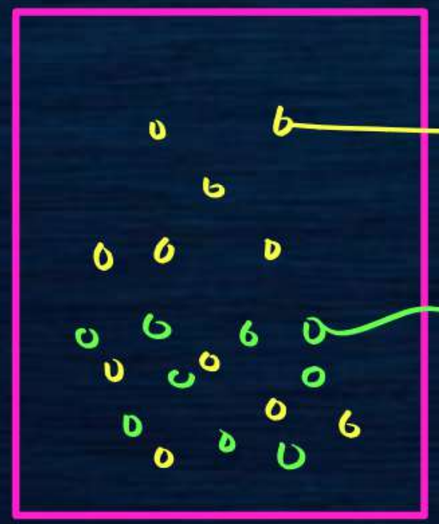
Q. 3.011×10^{23} atoms of He and 6.022×10^{22} atom of Ne present in a container. Calculate total number of mole of atoms.

A 0.5 mole

B 0.56 mole

C 0.4 mole

D 0.6 mole



6.022×10^{22} atom of Ne $= \frac{6.022 \times 10^{22}}{6.022 \times 10^{23}} = \frac{1}{10} = 0.1$ mole

3.011×10^{23} He atom $= \frac{3.011 \times 10^{23}}{6.022 \times 10^{23}} = \frac{1}{2} = 0.5$ mole

0.6 mole

Q. 0. 0.1 mole CO_2 gas present in a container, If 6.022×10^{21} molecules of CO_2, remove, calculate remaining mole of CO_2 gas in container.

A	0.99	✓ C	0.09
B	0.52	D	0.65

$$\begin{array}{r} 0.10 \\ -\ 0.01 \\ \hline .09 \end{array}$$

$0.1\,\text{mole}\ CO_2 - 6.022\times10^{21}\,\text{molecules} = ?\ \text{mole of}\ CO_2\ \text{gas}$

$0.1\,\text{mole}\ CO_2 - \dfrac{6.022\times10^{21}}{6.022\times10^{23}} = \dfrac{1}{100}$

$0.1 - 0.01 = 0.09\,\text{mole}$

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Thank - You